# Level 3 Structural formula

| | | |
|---|---|---|
| a carboxylic acid $C_4H_8O_2$ | N-ethylbutanamide | 2-amino-3-methylbutane |
| pentanal | 4-chlorobutanoic acid | $C_5H_{11}OH$ a branched-chain secondary alcohol |
| $C_5H_{11}OH$ a branched chain tertiary alcohol | N-methyl butanamide | 2-methylpropyl methanoate |
| 3-aminopentane | ethanoyl chloride | 2-chloropropan-1-ol |
| 2-methylbutanal | butanamide | 2-chloropentanal |

| | | |
|---|---|---|
| 2-amino-2,3-dimethyl butane | An acid chloride with 4 carbon atoms | An amino acid with 3 carbon atoms |
| butanamide | propanoyl chloride | trans isomer of $C_4H_8O$ |
| cis isomer of $C_4H_8O$ | pentan–2–one | ethanoyl chloride |

Additional questions on structural formula

**1)** Use the following information to answer this question.

**Compound W** is a branched chain molecule with a molecular formula $C_4H_{10}O$.

When **Compound W** is heated with excess acidified potassium dichromate it is readily oxidised to **Compound X,** which has acidic properties.

A substitution reaction occurs when **Compound X** is reacted with $SOCl_2$. The molecular formula of **Compound Y** is $C_4H_7OCl$.

When **Compound Y** reacts with aminomethane, $CH_3–NH_2$, a substitution reaction occurs and **Compound Z** forms.

Determine the structural formulae of **Compounds W**, **X**, **Y**, and **Z**.

Justify your answer by explaining how you arrived at these structures from the information given above. In your answer, you should:

- include other possible structural formulae you considered
- give your reasons for rejecting the other structural formulae.

**2)** Alcohol **A**, ($C_4H_{10}O$) can react with $Cr_2O_7^{2-}$ / $H^+$ to give compound **B** which does **not** react with Tollens' reagent. Compound **A** also reacts with $SOCl_2$ to give a haloalkane **C**, which when reacted with alcoholic KOH, gives two products, **D** and **E**, which are not geometric isomers. When **E** reacts with $H^+$ / $H_2O$, **A** is the product. When **D** reacts with $H^+$ / $H_2O$, two products are formed, **A** and **F**. **F** can be oxidised to form butanoic acid.
Give the structural formulae AND names for each of the compounds **A** to **F**.

**3)** A colourless liquid is known to be a branched-chain alcohol with the molecular formula $C_5H_{11}OH$.
Investigations of this liquid show the following features:

• It does not rotate the plane of polarised light.
• It reacts with acidified potassium dichromate solution.
• It reacts with concentrated sulfuric acid. The product of this reaction decolourises bromine water.

Use the features listed to determine which of the alcohols **A** to **E** is the colourless liquid. Justify your answer.